

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark
Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year)
16 March 1999 (16.03.99)
International application No.
PCT/US98/15910
International filing date (day/month/year)
27 July 1998 (27.07.98)
Applicant
HELGESON, John, P. et al

Applicant's or agent's file reference
WARF H108

Priority date (day/month/year)
30 July 1997 (30.07.97)

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

12 February 1999 (12.02.99)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer G. Bähr
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

REC'D 09 NOV 1999

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference WARF H108PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US98/15910	International filing date (day/month/year) 27 JULY 1998	Priority date (day/month/year) 30 JULY 1997
International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet.		
Applicant WISCONSIN ALUMNI RESEARCH FOUNDATION		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 12 FEBRUARY 1999	Date of completion of this report 20 OCTOBER 1999
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer MELISSA KIMBALL Telephone No. (703) 308-0196
Facsimile No. (703) 305-3230	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US98/15910

I. Basis of the report

1. This report has been drawn on the basis of (Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments):

the international application as originally filed.

the description, pages 1-27, as originally filed.

pages NONE, filed with the demand.

pages NONE, filed with the letter of _____.

pages _____, filed with the letter of _____.

the claims, Nos. 1-15, as originally filed.

Nos. NONE, as amended under Article 19.

Nos. NONE, filed with the demand.

Nos. NONE, filed with the letter of _____.

Nos. _____, filed with the letter of _____.

the drawings, sheets/fig 1-3, as originally filed.

sheets/fig NONE, filed with the demand.

sheets/fig NONE, filed with the letter of _____.

sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

the description, pages NONE.

the claims, Nos. NONE.

the drawings, sheets/fig NONE.

3. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the **Supplemental Box** Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. STATEMENT**

Novelty (N)	Claims <u>2-5, 7-15</u>	YES
	Claims <u>1, 6</u>	NO
Inventive Step (IS)	Claims <u>2</u>	YES
	Claims <u>1, 3-15</u>	NO
Industrial Applicability (IA)	Claims <u>1-15</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1 and 6 lack novelty under PCT Article 33(2) as being anticipated by Schumann et al.

Schumann et al. teach that somatic hybridization allows the introduction of resistance genes from wild species to cultivated potato and they teach the protoplast fusion of S. tuberosum and S. bulbocastanum. They teach screening resulting plants for Phytophthora resistance and that improved resistance was found in S. tuberosum + S. bulbocastanum hybrids.

Claims 1 and 3-15 lack an inventive step under PCT Article 33(3) as being obvious over Schumann et al. in view of Masuelli et al. and Gengenbach et al.

Schumann et al. teach the introduction of late blight resistance to S. tuberosum from S. bulbocastanum by somatic hybridization, as discussed above. They also teach screening the progeny to see the inheritance of isozymes.

Schumann et al. do not teach using RAPD or RFLP markers or their sequences nor do they teach methods of marker assisted selection. They do not teach a specific Phytophthora resistance gene, the introduction of any other type of resistance or transgenic introduction of resistance.

Masuelli et al. teach that S. bulbocastanum is a wild relative of cultivated potato (S. tuberosum) which is resistant to many nematodes and can be used as a source of resistance in cultivated potato breeding when differences in ploidy number are overcome. They teach somatic hybridization of the two species and repetitive backcrossing to limit the donor DNA to only the resistance gene of interest. They teach molecular markers (RAPDs) which can be used to identify the foreign DNA and are effective ways to fingerprint the species and hybrids.

Gengenbach et al. teach transgenic potatoes that overexpress foreign genes. They teach that particular promoters can be used to ensure expression in transgenic potatoes.

A skilled artisan would recognize that the Phytophthora-(Continued on Supplemental Sheet.)

Supplemental B x

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(6): A01H 5/00, 1/00, 1/04; C12N 15/05, 15/09, 15/11 and US Cl.: 800/317.2, 298, 301, 265, 267, 277, 279; 435/468; 536/23.1, 23.6

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):

resistant somatic hybrids taught by Schumann et al. contain foreign DNA that can be identified by marker selection whether said marker is an isozyme, RFLP or RAPD. The methods taught by Masuelli et al., backcross breeding, marker assisted selection, and resistance screening, would be used to isolate the S. bulbocastanum late blight resistance gene as well as nematode resistance genes. Once the gene(s) is identified a skilled artisan may choose to introduce it to cultivated potato transgenically as taught by Gengenbach et al. to avoid any ploidy compatibility problems. Introducing multiple resistance genes by either process has obvious advantages in increasing the resistance of new potato cultivars and decreasing the dependency of the grower on pesticides.

Claim 2 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a Phytophthora-resistance gene on chromosome 8 of S. bulbocastanum.

Claims 3-5 and 7-15 meet the criteria set out in PCT Article 33(2), because the prior art does not teach the exact methods and markers claimed.

Claims 1-15 meet the criteria set out in PCT Article 33(4), because the agricultural community benefits from forms of fungal resistance which decrease chemical application by saving application time and reducing adverse impact on the environment.

NEW CITATIONS

US 5,545,545 A (GENGENBACH et al.) 12 August 1996, see columns 3, 9 and 13.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/15910

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) A01H 5/00, 1/00, 1/04; C12N 15/05, 15/09, 15/11
 US CL 800/317.2, 298, 301, 265, 267, 277, 279; 435/468; 536/23.1, 23.6
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 800/317.2, 298, 301, 265, 267, 277, 279; 435/468; 536/23.1, 23.6

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, CABA, AGRICOLA, WPINDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^a	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P ---	HELGESON et al. Somatic hybrids between Solanum bulbocastanum and potato: a new source of resistance to late blight. Theoretical and Applied Genetics. 1998. pp. 738-742, see entire article.	1,2,5,6,10 -----
Y, P	THIEME et al. Production of somatic hybrids between S tuberosum L. and late blight resistant Mexican wild potato species. Euphytica. 1997. Vol. 97. Number 2, pp. 189-200, see entire article.	3,4,7-9,11-15
X -- Y	SCHUMANN et al. Somatic hybridization of Solanum tuberosum L. with Phytophthora-resistant wild potato species. Physiologia Plantarum. 1991. Vol. 82. pp. A23, abstract 134, see entire abstract.	1,2,5,6,10 ----- 3,4,7-9,11-15
X -- Y		1,5,6 ----- 2,10

Further documents are listed in the continuation of Box C. See patent family annex.

• Special categories of cited documents:	*T*	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
B earlier document published on or after the international filing date	*Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*&*	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

19 OCTOBER 1998

Date of mailing of the international search report

03 NOV 1998

Name and mailing address of the ISA/US
 Commissioner of Patents and Trademarks
 Box PCT
 Washington, D.C. 20231

Authorized by
 MELISSA KIMBALL

Facsimile No. (703) 305-3230

Telephone No. (703) 308-0196

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US98/15910

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category ^a	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US 5,750,874 A (STRITTMATTER et al.) 12 May 1998, example 3, col. 16-18.	1,7,12-15
A	MASUELLI et al. Irregular meiosis in a somatic hybrid between <i>S. bulbocastanum</i> and <i>S. tuberosum</i> detected by species-specific PCR markers and cytological analysis. <i>Theoretical and Applied Genetics</i> . 1995. Vol. 91. pp. 401-408, see especially page 401, col. 1 and page 402, col. 2.	1-15



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A01H 5/00, 1/00, 1/04, C12N 15/05, 15/09, 15/11		A1	(11) International Publication Number: WO 99/05903
			(43) International Publication Date: 11 February 1999 (11.02.99)
(21) International Application Number: PCT/US98/15910		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 27 July 1998 (27.07.98)			
(30) Priority Data: 60/054,267 30 July 1997 (30.07.97) US			
(71) Applicant (for all designated States except US): WISCONSIN ALUMNI RESEARCH FOUNDATION [US/US]; 614 Walnut Street, Madison, WI 53705 (US).			
(72) Inventors; and		Published	
(75) Inventors/Applicants (for US only): HELGESON, John, P. [US/US]; 809 Oneida Place, Madison, WI 53711 (US). AUSTIN, Sandra [US/US]; 2337 Fox Avenue, Madison, WI 53711 (US). NAESS, Sara, K. [US/US]; 2586 Prairie Ridge Road, Verona, WI 53593 (US).		With international search report.	
(74) Agents: REED, Janet, E. et al.; Dann Dorfman Herrell & Skillman, Suite 720, 1601 Market Street, Philadelphia, PA 19103-2307 (US).			

(54) Title: **GERMPLASM AND MOLECULAR MARKERS FOR DISEASE RESISTANCE IN POTATO**

(57) Abstract

This invention provides novel germplasm, breeding stock, genetic markers and methods for introducing resistance to late blight and other diseases into cultivated potato plants. The germplasm is derived from a segment of the *Solanum bulbocastanum* genome that contains one or more genes conferring resistance to late blight. The *S. bulbocastanum* genome is introduced into cultivated potato by somatic hybridization of *S. bulbocastanum* with *S. tuberosum*. Also provided is a *S. bulbocastanum* RAPD fragment marker that co-segregates with the disease resistance gene. In addition, chromosome 8 RFLP markers are provided, which also are tightly linked to the resistance gene(s). These markers are used to monitor passage of the disease resistance trait in breeding crosses. The markers are also used to facilitate isolation of the *S. bulbocastanum* gene or genes responsible for the disease resistance.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

PATENT COOPERATION TREATY

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

REED, Janet, E.
 Dann Dorfman Herrell & Skillman
 Suite 720
 1601 Market Street
 Philadelphia, PA 19103-2307
 ÉTATS-UNIS D'AMÉRIQUE

Date of mailing (day/month/year) 11 February 1999 (11.02.99)			
Applicant's or agent's file reference WARF H108		IMPORTANT NOTICE	
International application No. PCT/US98/15910	International filing date (day/month/year) 27 July 1998 (27.07.98)	Priority date (day/month/year) 30 July 1997 (30.07.97)	
Applicant WISCONSIN ALUMNI RESEARCH FOUNDATION et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU, BR, CN, EP, IL, JP, KP, KR, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AL, AM, AP, AT, AZ, BA, BB, BG, BY, CA, CH, CU, CZ, DE, DK, EA, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, OA, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 11 February 1999 (11.02.99) under No. WO 99/05903

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38